EX PARTE OR LATE FILED

ORIGINAL

GE American Communications

Alexander P. Humphrey, IV
Washington Counsel

General Electric Company
1299 Pennsylvania Ave., N.W., Suite 1100
Washington, DC 20004-2407
202 637-4115, Fx: 202 637-4578

March 2, 1995

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Re: ET Docket No. 94-124

Dear Mr. Caton:

Enclosed for filing herewith are an original and five copies of reply comments of GE American Communications, Inc. in the above-referenced docket.

Leave is requested to file these comments one day late. Unanticipated absences of support personnel necessary to prepare, copy, file and serve these comments prevented a timely filing. Since the pleading cycle closes with these comments, no party will be prejudiced, and we submit that a filing at this point will not delay the Commission's timely disposition of this matter.

Will you please date stamp the copy marked return and return it to the undersigned in the enclosed envelope.

Respectfully submitted,

Alexander P. Humphrey

Encs.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications	)	ET Docket No. 94-124

REPLY COMMENTS OF
GE AMERICAN COMMUNICATIONS, INC.

Philip V. Otero
Alexander P. Humphrey
GE AMERICAN COMMUNICATIONS, INC.
1750 Old Meadow Road
McLean, VA 22102-4306
(703) 848-1216

March 2, 1995

Summary

In these reply comments, GE Americom endorses the Commission's decision to open up the 40 GHz "millimeter" bands for commercial services. It is filing these comments to address the comments of CellularVision, a provider of Local Multipoint Distribution Service (LMDS), which sought the Commission not to follow the request of GE Americom and other commenters that a portion of the 40 GHz band be allocated to LMDS providers, even though this step would give CellularVision and others exclusive use of the new frequencies while allowing satellites to proceed to develop the 28 GHz Ka-band.

In these reply comments, GE Americom shows that CellularVision's claims that requiring it to operate LMDS at 40 GHz would cause it to incur cost increases of 30 to 40 percent are overstated. There are a number of ways that CellularVision can operate LMDS in the 40 GHz band without incurring significant cost increases or providing inferior service to subscribers, and any cost increases are small in comparison to the public interest of beginning commercial use of the 40 GHz band and eliminating interference in the 28 GHz band.

This being the case, the Commission should proceed to allocate the 40 GHz band for use by LMDS. This will allow a prompt implementation of service at that band, while freeing up the 28 GHz so that it can be used for delivery of broadband services by Ka-band satellites.

Table of Contents

List of Figures

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications	)	ET Docket No. 94-124

REPLY COMMENTS OF
GE AMERICAN COMMUNICATIONS, INC.

Introduction

GE American Communications, Inc. ("GE Americom") is interested in this proceeding as a potential provider of Ka-band satellite services. The Commission has announced a C- and Ku-band satellite processing round that would, if GE Americom and the other applicants are awarded the authority they seek, completely fill the usable arc for C- and Ku-band services, making additional spectrum necessary in order to meet customer demands for broadband services that will arise in the Information Age. Such spectrum is available in the Ka-band but is at present not capable of development, due to unresolved interference concerns between Ka-band satellites and Land Multipoint Distribution Services, which appear insoluble.

In its opening comments, therefore, GE Americom supported the Commission's proposal to open the millimeter frequency bands above 40 GHz for commercial use. GE Americom also urged the Commission to take the further step of using this proceeding to allocate the 40.5-42.5 GHz (40 GHz) band for LMDS. This would not only give LMDS an opportunity to pioneer a new frequency band

but would at the same time eliminate the potential interference concerns in the 28 MHz band that have prevented both LMDS and Ka-band satellites from implementing operations on a widespread basis. For the Commission to make this allocation would thus eliminate interference and allow the marketplace rather than the Commission to choose the technology that best suits customer needs in the Information Age.

In support of the proposed allocation of the 40 GHz band to LMDS, GE Americom set forth its belief that the propagation characteristics of the 40 GHz band were not dissimilar to those at 28 GHz as far as LMDS is concerned. Thus, if the Commission were to make this allocation, LMDS could initiate operations in the 40 GHz band with little modifications to its plant and without compromises in the services it provides to its subscribers, to whom the change in frequency would be transparent.

To prevent the Commission from finding that it is in the public interest to give LMDS an exclusive allocation in the 40 GHz band, CellularVision, whose affiliate has a limited LMDS system in operation in one New York suburb, opposes such an allocation. According to CellularVision, LMDS would not be "viable" in the 40 GHz band because operations there would increase system costs between "30 and 40 percent." It does not quantify these increases, and, it is important to note that, in pioneering the C- and Ku-bands, satellite companies and their customers have spent billions of dollars to build a business.

CellularVision's argument that LMDS would not be viable at 40 GHz rests in large part upon its claim that, due to differences in propagation characteristics between the 28 GHz and 40 GHz bands, the maximum range of an LMDS "cell" in the New York area would be reduced from 5 kilometers (3 miles) to 1.85 kilometers (1.15 miles). This would, in turn, increase the number of cells to serve the same population base.

To equip the additional number of cells, CellularVision claims that it would require 7.3 times as many hub transmitters than would be used for operations at 28 GHz.[1] Further, according to CellularVision, it would also need upgraded transmitter equipment at each site, which it claims costs twice as much as that assumed for operations at 28 GHz,[2] as well as upgraded receiver equipment, which would increase its costs by a factor of 75 to 100 percent.[3] Finally, CellularVision claims it would risk some unquantified loss of subscribers not in the line-of-sight with a LMDS transmitter hub who could receive a LMDS signal due to reflections off buildings and other structures at 28 GHz but not at 40 GHz, resulting in another doubling of system costs.[4]

CellularVision's estimate of a 30 to 40 percent increase in

---

[1] These claims are set forth in Appendix 2 to the Comments of CellularVision, hereinafter referred to as "Appendix 2."

[2] Appendix 2 at 6

[3] Ibid. at 8.

[4] Ibid. at 9.

cost is like a house of cards, since it depends on the critical assumption that 40 GHz LMDS cells would have to diminish in size from those suitable for 28 GHz and thus increase in number. Absent this assumption, CellularVision would have no technically acceptable reason not to provide LMDS service at 40 GHz. As GE Americom shows here, CellularVision can continue, with minor plant modifications, to offer service at 40 GHz without a material loss in quality and without any sacrifice to a system design based upon three-mile cells.

If this barely noticeable decrease in signal quality in unacceptable, it could, with slightly different antennas, reduce cells only to 2.3 miles -- not to the 1.5 miles it projects -- and obtain the same quality of signals at 40 GHz used in its illustrative link budget. Alternatively, CellularVision could, by using slightly larger antennas, retain its present cell size and number of cells, out of which it could deliver signals with the same margins as those it considers to be necessary for viability. Although some additional costs might be involved, these would not be the staggering ones forecast by CellularVision and are a fraction of those of satellite companies that pioneered the C- and Ku-bands and which will be likely to use in the Ka-band.

Thus CeullarVision's parade of horribles is overblown[5] and

---

[5] It is highly significant in this regard that Texas Instruments, which is an equipment manufacturer, posits its objection to moving LMDS to 40 GHz not on the increased cost of equipment but the increased amount of equipment needed. Comments at 1.

does not present the Commission with any legitimate reason not to make an allocation of the 40 GHz band to LMDS.

I.

CELLULARVISION CAN RETAIN THE SAME SYSTEM DESIGN WITHOUT MATERIALLY INCREASING THE NUMBER OF CELLS

At the heart of CellularVision's contention that system costs will increase by 30 to 40 percent are its claims that cell size will have to be decreased from 3 to 1.5 miles to maintain viable operations. This is not the case, however, since CellularVision can transmit acceptable signals to its subscribers at 40 GHz without decreasing the size of its cells and increasing their number, which it can do by augmenting its present plant with only slight modifications and using transmitters no more powerful than those shown in its link budget.

Alternatively, with further modifications of its receivers, CellularVision can transmit uninterrupted high-quality signals at 40 GHz without reducing its cell sizes down to 1.5 miles, which would render unnecessary the installation of additional hub sites and the concomitant equipment costs. By installing two-foot antennas, Cellular Vision can continue present quality signals out of three-mile cells.

A. Performance Characteristics in the 40 GHz Band are Not Significantly Different from those in the 28 GHz Band

CellularVision's claims that it will have to reduce cell size in order to retain transmission quality at 40 GHz can not withstand analysis. The 40 GHz band offers essentially the same performance characteristics as the 28 GHz band. As shown in

Figure 1 attached hereto, signal attenuation caused by atmospheric absorption is about the same at 40 GHz as at 28 GHz. Also, interference with millimeter waves caused by foliage is not significantly greater at 40 GHz than at 28 GHz. While there is a increase in signal losses due to vegetation as between radio waves at 9.6 GHz and 29 GHz, the amount of additional loss between 28 and 57 GHz is only a negligible amount.[6]

A reduction in cell size is likewise not necessary to reach subscribers not in the line-of-sight of a LMDS hub at 40 GHz, since the literature shows that there are minimal differences in reflectivity of surfaces between 28 GHz and 57 GHz radio waves.[7]

B. Even Taking Rain Attenuation Into Account, Cellular Vision Could Still Offer Acceptable Services Without Any Sacrifice to Cell Size

CellularVision's case for reduced cell sizes and resulting increase in equipment costs thus boils down to the attenuation of LMDS signals at 40 GHz due to rain. The attenuation caused by rain does affect system performance more at 40 GHz than at 28 GHz. This notwithstanding, with slight system modifications and augmenting its plant with 40 GHz transmitters no more powerful than 28 GHz transmitters assumed in CellularVision's calculations, an LMDS provider such as CellularVision could

---

[6] Schwering, Violette and Expeland, "Millimeter-Wave Propagation in Vegetation: Experiments and Theory," IEEE Transactions on GeoScience and Remote Sensing, Vol. 26, No. 3 (May 1988).

[7] Violette, Speland, DeBolt and Schwering,"Millimeter-Wave Propagation at Street Level in an Urban Environment," IEEE Transaction[s] on GeoScience and R@emote Sensing, Vol. 26, No. 3 (May 1988).

retain its present cell size of 3 miles in New York[8] and provide service only marginally different than that assumed in its 40 GHz calculations.

Transmission quality is measured on how often service is available, with the highest industry standard being 99.9 percent of the time.[9] This means that high-quality signals would be available 99.9 percent of the time -- i.e., all times except for 2.6 hours per year during typical household viewing hours.[10] If CellularVision were to make slight modifications in its plant, it could still use three-mile cells to produce signals of acceptable quality to subscribers. With slightly larger antennas, the availability of an optimum signal in an area with the same rainfall characteristics of New York would, in GE Americom's estimation, be reduced 99.7 percent.[11] This means that there

---

[8] Of course, in rainier climates, such as the Southeast, a LMDS provider might have to increase transmitter power and/or reduce cell size even at 28 GHz.

[9] An availability rate of 99.9% is used in CellularVision's calculations, but GE Americom is uncertain whether CellularVision's limited operations at 28 GHz actually deliver this level of service now or whether it is a target for future operations.

[10] Because the 99.9% figure is measured at the periphery of the viewing area, this would mean that subscribers close to a LMDS transmitter would experience no significant degradation. In addition, the analog transmissions used by CellularVision are relatively tolerant to degraded power, meaning that the signal during periods of rain might show some snow on the screen, as distinct from a complete loss of signal.

[11] GE Americom derived this estimate using standard industry calculations contained in "Propagation and Non-Ionized Media," Reports of the CCIR,, Vol. V (Annex), Report Nos. 721-3, 563-4, 338-6 (1990).

would be a sightly degraded signal 7.7 hours per year for a typical viewing household.

In a number of direct-to-home (DTH) satellite applications involving video, with which CellularVision would be completing, a 99.7 percent signal availability is acceptable. With this signal quality, the two DTH services in operation have signed up hundreds of thousands of subscribers already, with a significant number of more subscribers likely in the future. In GE Americom's estimation, this additional amount of additional unavailability of the highest quality signals is a small price to pay for freeing up the 28 GHz band for operation by Ka-band satellites, who can bring interference-free broadband service to millions of viewers worldwide.

C. Modification of The Commission's Proposed Transmitter Output Limitations Would Restore Complete System Availability

There is no reason for LMDS viewers to suffer any degradation in viewing signal, no matter how small. Modification of the proposed rules insofar as power limitations are concerned should ensure continuation of a 99.9 rate of availability without any adjustment in cell size below the 3.0 miles CellularVision considers optimal at 28 GHz. If the Commission were to relax its proposed requirement that the power of licensed transmitters be limited to 16 dBW, additional power would be available at the hub sites to overcome the effects of rain. The increase of transmitting power coupled with slightly more efficient antennas will offset any effects of rain attenuation. If the Commission

takes bandwidth into consideration by allowing LMDS transmitters to multiplex channels together, this will allow the use of 100 watt traveling wave tube amplifiers, which would raise the +16.5 dBW of the 40 GHz transmitter shown in CellularVision's link budget[12] by +3.5 dBW, restoring the +20 dBW that CellularVision presumably believes is necessary to create a viable LMDS system at 40 GHz.

D. Replacement of CellularVision's Spectrally Inefficient Receivers Will Also Permit Operations With Little Adjustment to Cell Sizes

Even if the Commission does not relax the transmitter power limitation, CellularVision's claims that 40 GHz operations would require denser cell sites still are not convincing, since a minor upgrade in subscriber receivers would save CellularVision much of the equipment costs involved in the increase in the number of cells attributable to the reduction of its cell range.

If CellularVision were to exchange its inefficient antennas even for parabolic antennas one feet in diameter, system margins would improve to be identical to those at 28 GHz at 2.3 mile cell sites. This is shown in Figure 2.

In restating CellularVision's link budget in Figure 2, GE Americom accepted CellularVision's estimate that available 40 GHz transmitters are about 3.5 dB lower in power than those currently

---

[12] Appendix 2 at 5.

available at 28 GHz.[13] We also accepted CellularVision's assertion that there was another 0.5 dB of additional loss in the system due to transmitter line loss, producing a net loss of 4 dB at the transmitter site.

Where GE Americom disagrees with CellularVision is on the appropriate performance of receive antennas at the subscriber locations. CellularVision asserts that it requires a 4° beamwidth antenna in order to account for alignment tolerances and mechanical use.[14] If CellularVision were to use a 1 foot 40 GHz parabolic dish, it would result in 41 dB in gain -- or 8 dB more than the antenna CellularVision proposes to use in 28 GHz operations. The 3 dB beamwidth of a one-foot antenna is about 1.7°. While this tolerance is considerably less than the 4° that CellularVision proposes for its system, it has improved sidelobe performance and a greater degree of discrimination between cross-polarized signals, resulting in improved system performance in a multipath environment. But what is important to note is that this change in system design would not result in the use of exotic, untried technology. Thousands of satellite antennas are in use that fall within the 1.7° bandwidth. For example, a 1.7° bandwidth 40 GHz antenna is equivalent to the bandwidth of a one meter Ku-band antenna and a 10 foot C-band antenna, both of which

---

[13] In order to keep its estimates conservative, GE Americom assumed that CellularVision would not combine its transmitters or that higher-powered transmitters would not be available, both of which assumptions are subject to question.

[14] Appendix 2 at 7.

are widely used in the DTH market today. While GE Americom will not speculate on the cost of such antennas, they would certainly be less than the 30 to 40-fold increase forecast by CellularVision. As DTH equipment has fallen in costs by economies of scale in the manufacturing process and pent-up consumer demand, the additional costs to CellularVision, if any, would be minor.[15]

As a result of the improved antenna gain using a one-foot 40 GHz antenna, CellularVision would only have to reduce its cell sites in New York from 3 miles to 2.3 miles in order to obtain the 99.9 percent availability on which its calculations are based. Alternatively, it could use one-foot antennas in three-mile cells and attain a 99.7 percent rate of availability.

If, on the other hand, CellularVision wanted to have identical performance at 40 GHz as it has at 28 GHz, including an availability rate of 99.9 percent and three-mile cells, it could install two-foot dishes at subscriber sites. Figure 2 restates CellularVision's link budget but using a two-foot dish instead. This shows that, even for the 3.0 mile cell site that CellularVision assumed in its calculations, performance identical to that described in its 28 GHz link budget could be obtained at 40 GHz by the use of a two-foot antenna.

---

[15] While costs of transmitters and receivers may be slightly higher, these would be offset by the fact that the number of its hub sites need not be increased significantly, requiring less transmitter equipment than forecast by CellularVision.

Conclusion

While GE Americom is not in the position of deciding what tradeoffs CellularVision seeks to make, it appears clear at this point that CellularVision has a number of options at hand that will make LMDS operations at 40 GHz viable because of the small alteration of cell sizes and concomitant increases in cell numbers that would actually be involved. If it wishes to retain its existing three-mile cell sites, CellularVision can accept a slightly smaller availability of service at 40 GHz at the minimum cost of using one-foot antennas with no increase in transmission power.[16] It can, by replacing its inefficient subscriber antennas with those small parabolic dishes, produce quality signals 99.9 percent of the time out of hub sites reduced in size from 3 miles to 2.3 miles. Alternatively, it can have the best of both worlds by retaining existing three-mile cell sites while providing signals with a 99.9 availability by installing two-foot antennas.

GE Americom is not denying that some costs will be involved. But what we are talking about is only one licensed LMDS provider, with limited coverage, and costs that will be minuscule in comparison to the strong public interest of resolving of opening up both the 40 GHz and the 28 GHz bands to services sought by customers.

In any event, there is no basis for CeullarVision's claim

---

[16] If the Commission increases the power limitations it has proposed, even smaller replacement antennas could be used.

that being required to operate at 40 GHz will bring about a "30 to 40" percent increase in costs that would make service in this band non-viable. This being the case, the Commission should proceed to allocate the 40 GHz band to LMDS so that operations there and satellite operations at the Ka-band can commerce at the earliest possible moment.

Respectfully submitted,

Philip V. Otero
Alexander P. Humphrey
GE AMERICAN COMMUNICATIONS, INC.
1750 Old Meadow Road
McLean, VA 22102-4306

Certificate of Service

I, Wanda M. Latta, hereby certify that, on this second day of March, 1995, I served the foregoing Reply Comments by mailing, by first-class postage prepaid, to the following:

Michael R. Gardner
Charles R. Milkis
Rafael C. Prohias
1150 Connecticut Ave.
Suite 710
Washington, DC 20036

Thomas E. Kligo
Texas Instruments Incorporated
PO Box 650311
Dallas, TX 75266

Wanda M. Latta

Figure 1

Atmospheric Absorption of Millimeter Waves

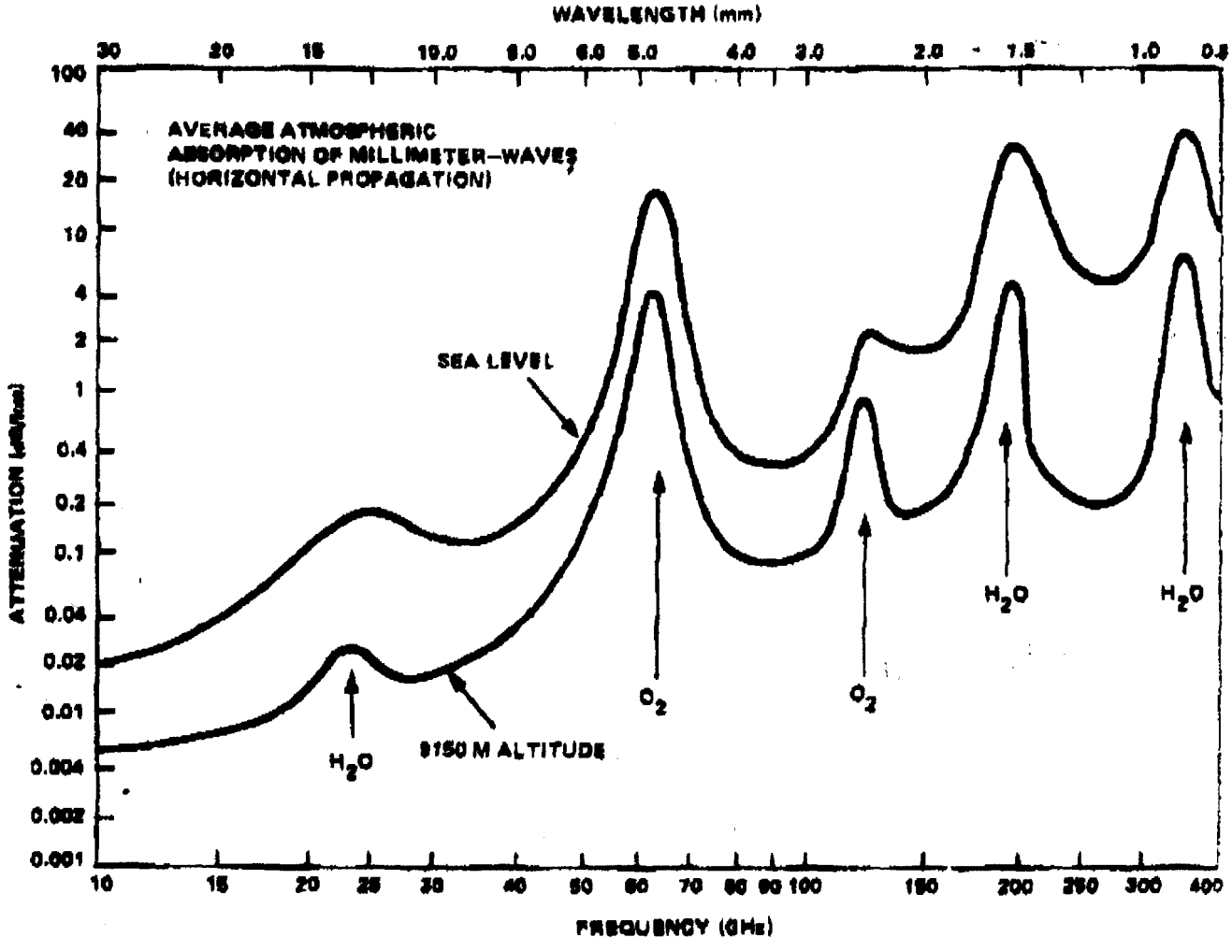

Figure 2

CELLULAR VISION WOULD NOT HAVE TO MAKE MAJOR REDUCTION IN CELL AREAS IF IT USED IMPROVED ONE FOOT ANTENNAS

SYSTEM PARAMETER	40 GHz 1' DISH
Transmitter Power	+16.5 Dbw
7 Db Backoff	+9.5 Dbw
50- Channel (-17 dB)	-7.5 dBW /channel
Transmitter Line Loss	-9.0 dBW/channel
Transmitter Antenna Gain	+3 dBW/channel
Range	2.3 miles
Path Loss Rain Zone K 99.9%	-151.3 dB
Isotropic Receive Level	-148.3 dBW/channel
Receive Antenna Gain	+41 dBi
Received Carrier level	-107.3 dBW/channel
Receiver Noise Figure	8 dB
Receiver Noise level (18.6 MHz bandwidth)	-123.4 dBW/channel
Carrier to Noise Ratio	16 dB
Video SNR	45 dB

Figure 3

NO CHANGE IN CELL SIZES OR SIGNAL QUALITY WOULD BE INVOLVED IF CELLULARVISION USED TWO-FOOT ANTENNAS

SYSTEM PARAMETER	**40 GHz 2' DISH**
Transmitter Power	+16.5 Dbw
7 Db Backoff	+9.5 Dbw
50- Channel (-17 dB)	-7.5 dBW /channel
Transmitter Line Loss	-9.0 dBW/channel
Transmitter Antenna Gain	+3 dBW/channel
Range	3.0 miles
Path Loss Rain Zone K 99.9%	-157.3 dB
Isotropic Receive Level	-154.3 dBW/channel
Receive Antenna Gain	+47 dBi
Received Carrier level	-107.3 dBW/channel
Receiver Noise Figure	8 dB
Receiver Noise level (18.6 MHz bandwidth)	-123.4 dBW/channel
Carrier to Noise Ratio	16 dB
Video SNR	45 dB